

CASE STUDY #71 and #72
PIT RIVER #6 AND PIT RIVER #7 RESERVOIRS

I. Project Description

The Pit River is the main tributary to the Sacramento River above Shasta Dam. It is formed near Alturas by the junction of its north and south forks, and flows southwest-erly toward Shasta Reservoir. Pit #6 and Pit #7 are dams on the Pit River immediately above Lake Shasta. Pit #7 is 6.5 miles downstream from Pit #6, such that its backwaters extend upstream to Pit #6. Powerhouses are located directly below each dam (see Figures 1 and 2).

To modulate the widely fluctuating releases associated with power production, an afterbay weir is located below Pit #7. This afterbay is inundated during high water in Lake Shasta. Pit #7 is the larger of the two reservoirs with a capacity of 34,000 acre-feet and a surface area of 470 acres. Pit #6 contains 15,700 acre-feet covering 265 acres. Both reservoirs were completed in 1965.

In 1961 the Federal Power Commission issued License No. FPC 2106 to PG&E for the Pit-McCloud power project which includes the McCloud River diversion structures, Iron Canyon Reservoir and Pit #6 and #7 (Figure 2).

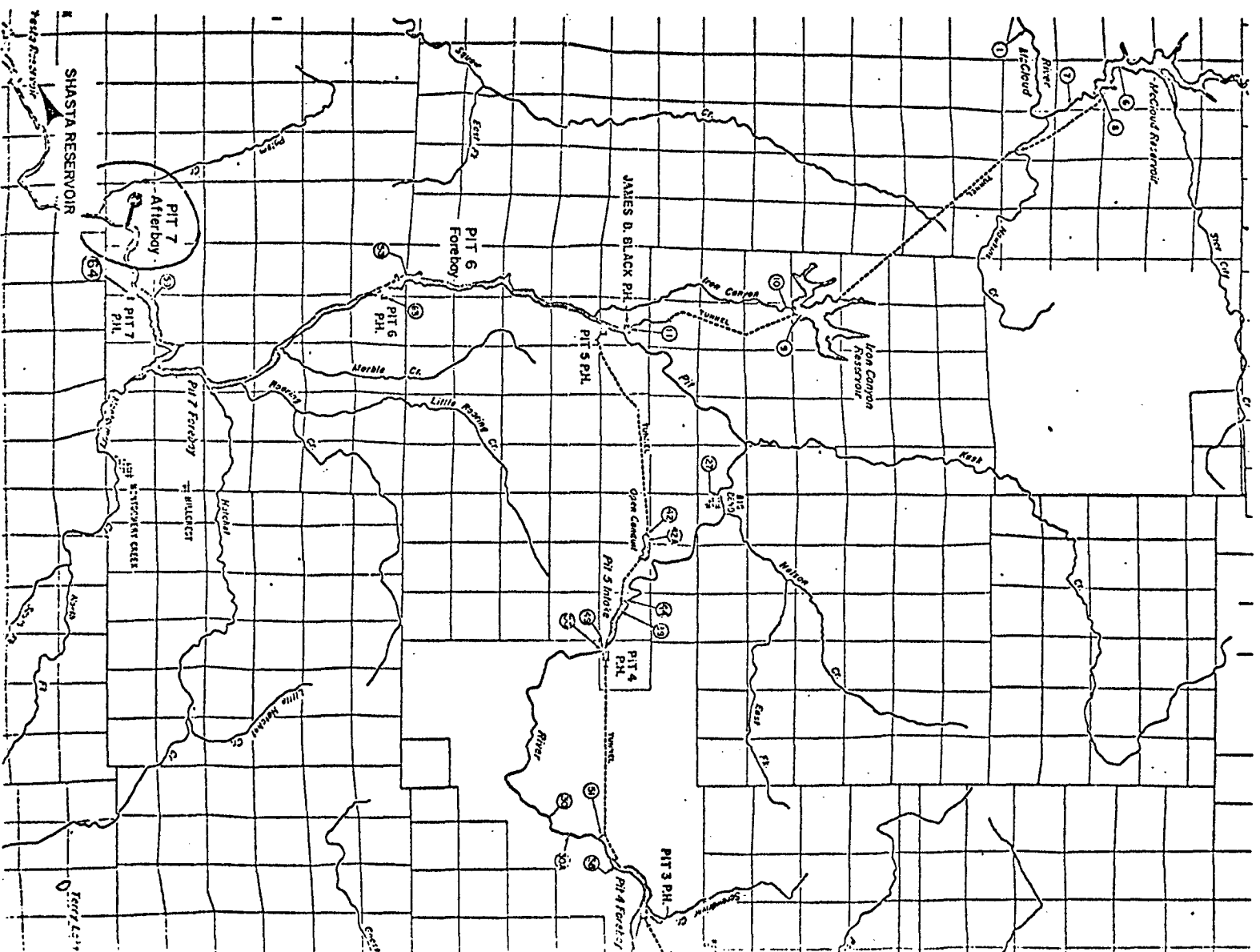
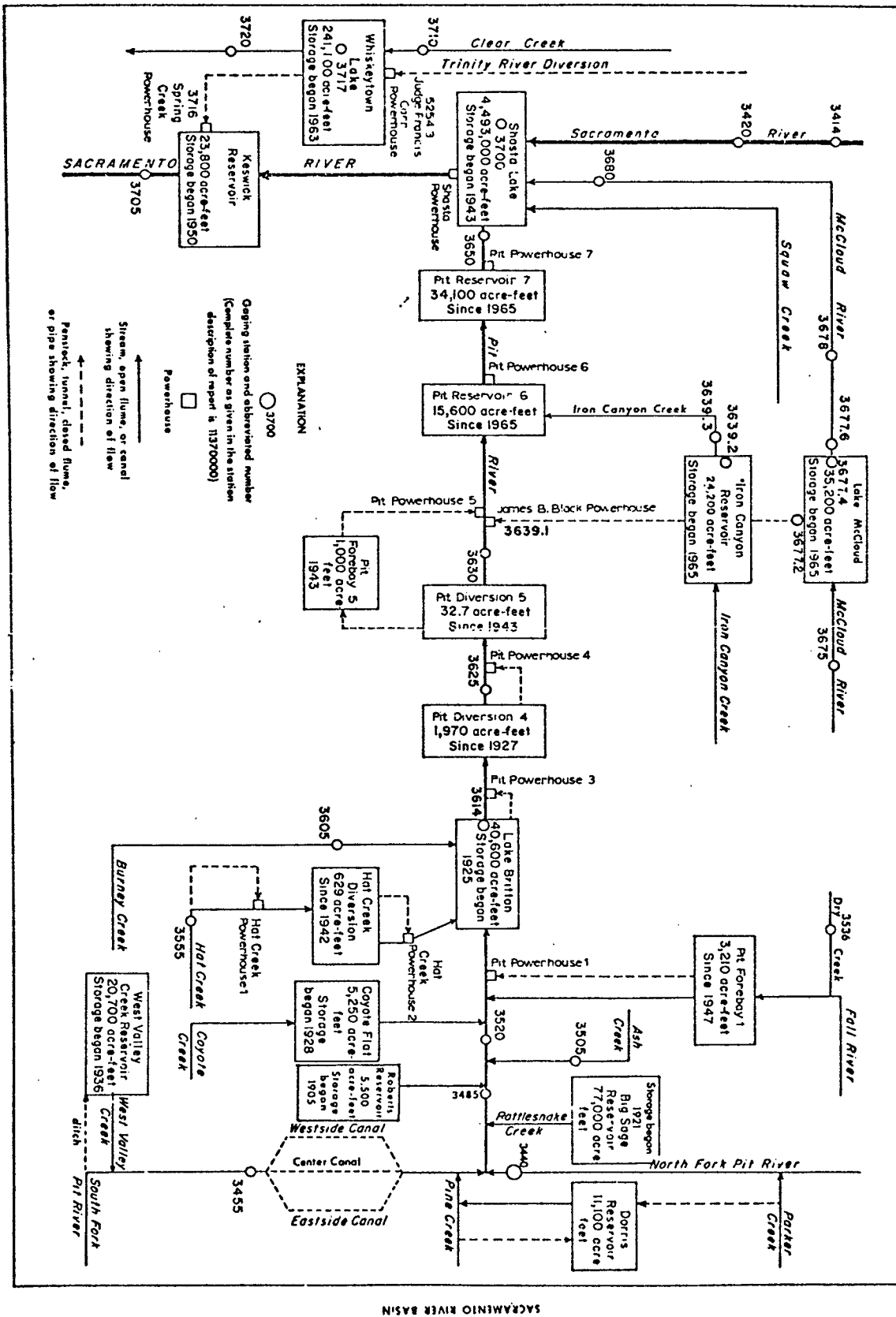


Figure 1
LOCATION MAP
PIT RIVER



--Schematic diagram showing diversions and storage in Pit and McCloud river basins.

Figure 2

Source: U. S. Geological Survey, 1973,
 water resources data for California.

II. Pre-Project Conditions

The Pit River watershed is in lava formations which absorb heavy winter rains and release groundwater gradually throughout the year (Curtis, 1959). Therefore, under natural conditions it does not exhibit the extreme seasonal fluctuations common to many California streams. Mean annual pre-project flows near the present Pit #7 dam site were 3,630 cubic feet per second (cfs) over a 16-year period. Minimum pre-project flows in the summer during the same period were 2,000 cfs (see Figure 3).

Prior to 1965 stream flow in the Pit River was influenced by several reservoirs and power plants (see Figure 2). One of the earliest major projects on the Pit River was Lake Brittan which was constructed in 1925. Reservoirs on tributary streams were influencing flows along the Pit River earlier than 1925 (see Figure 2).

The Pit River was reported (Curtis, 1959) to support a mixed fish population prior to the construction of Pit #6 and #7 which included rainbow trout, suckers, hardhead and other non-game fish. Several species of game and non-game fish in Lake Shasta use the Pit River and its tributaries for spawning and rearing. Kokanee salmon, planted in Lake Shasta in 1953, were observed spawning in the tributaries of the Pit during the 1955 to 1960 period. White sturgeon have been observed to spawn as far upstream as Montgomery Creek near the present Pit #7 dam site (Department of Fish and Game Memorandum, 1958).

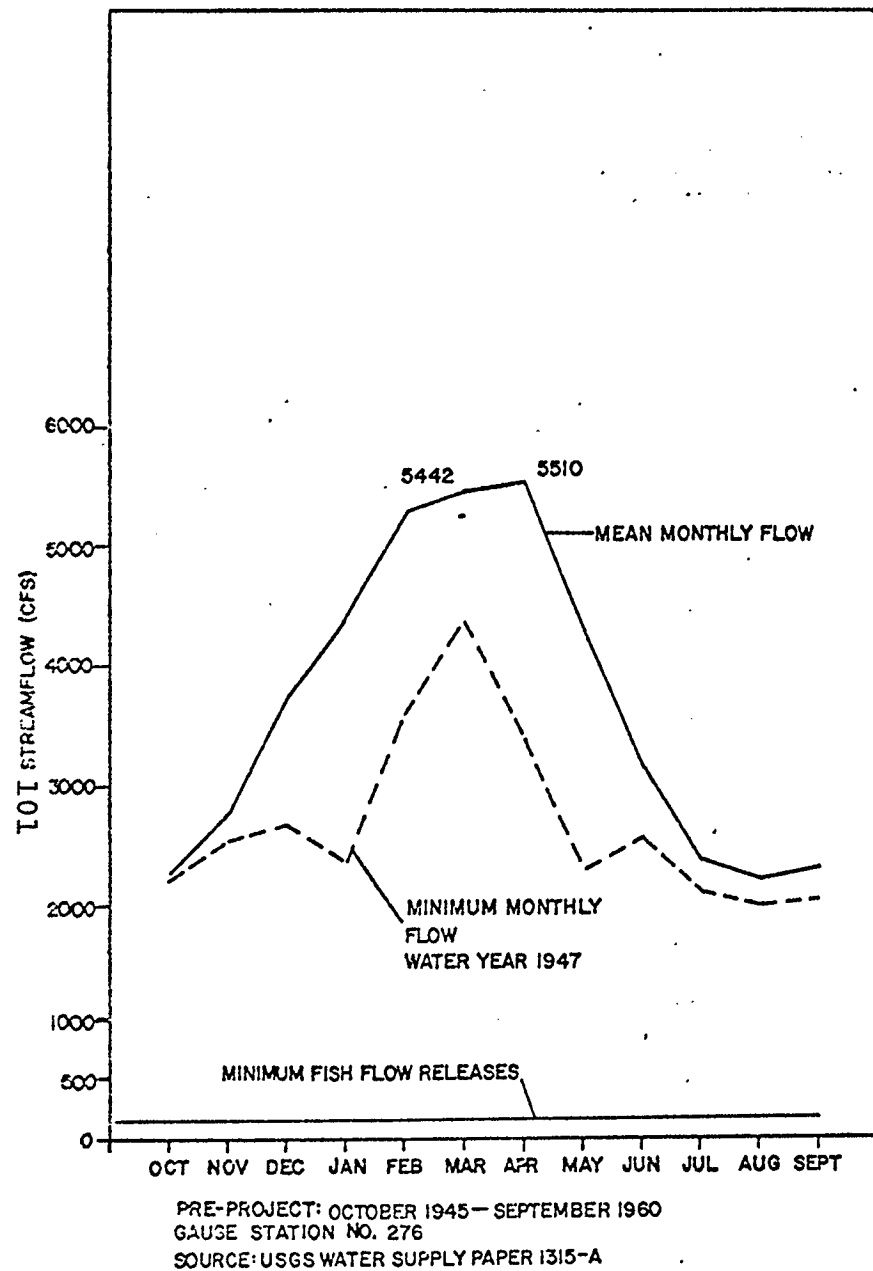
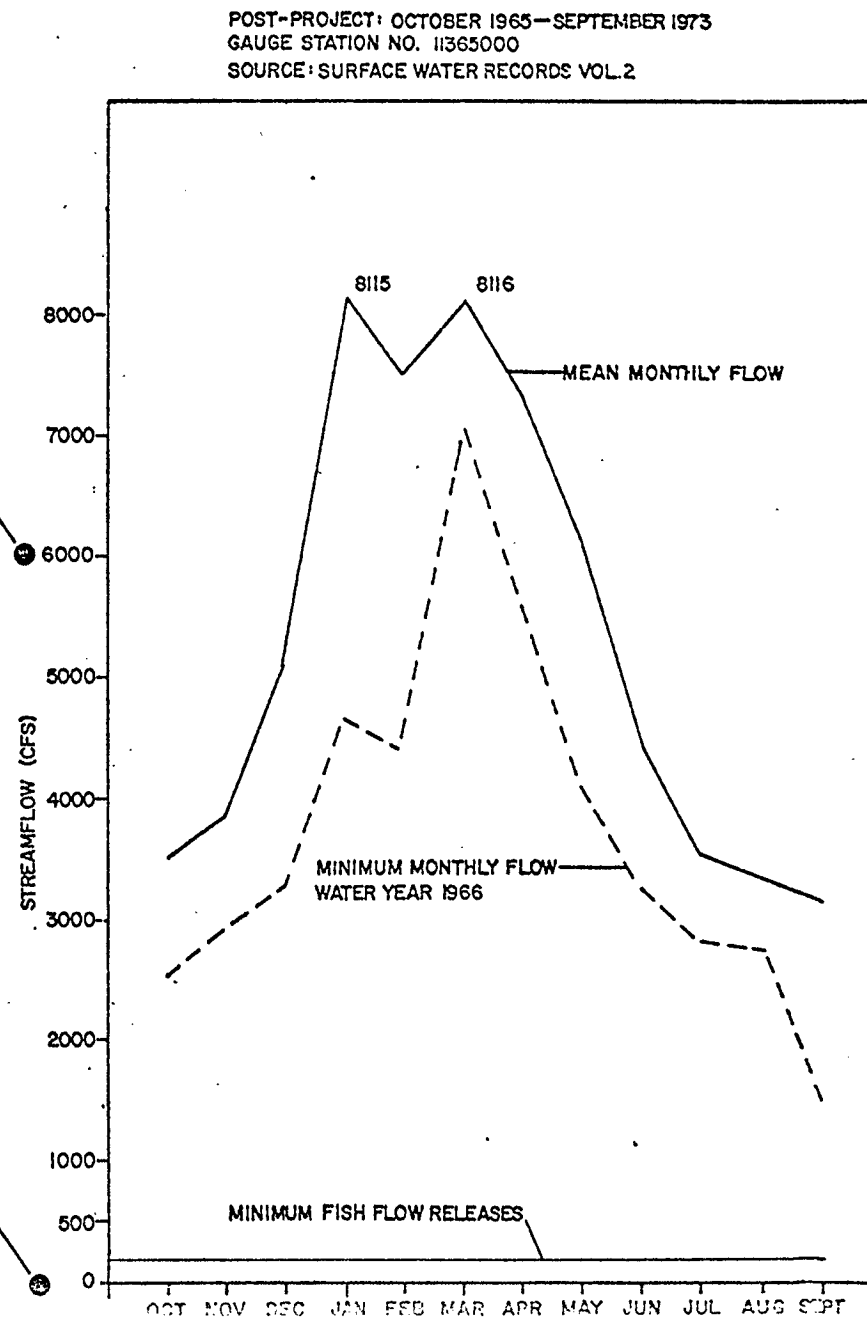


FIGURE 3
STREAMFLOW CONDITIONS, PIT RIVER
PIT NO. 6 & PIT NO.7 RESERVOIRS



Salmon and steelhead runs were cut off from their historical spawning areas in the Pit River by Shasta Dam in December 1943. A potential of 14,402 spawning nests was estimated by surveyors in the lower 28 miles from the mouth to Fenders Ferry in 1939 (Hanson, Needham, 1940).

III. Project Development

Two years following the 1952 application for Pit #6 (FPC 2104), PG&E filed an application for the Pit #7 project (FPC 2137). Both applications were for inclusion in the McCloud River diversion dam project. A 50-year license for the McCloud-Pit project (FPC 2106) was granted in August 1961.

The license (FPC 2106) required that releases from Pit #7 be "150 cfs minimum at all times except when the elevation of Shasta Lake is at invert of draft tube of Pit #7 Powerhouse". Article 47 of this license further required PG&E to "construct egg taking, trapping, hatching, rearing and planting facilities for the compensation of lost spawning areas". PG&E in a hearing before the Federal Power Commission requested a change in FPC license 2106, Article 47A to delete the fish hatchery requirement, and an amendment to the license was granted in May 1962. The new article (#47) required that PG&E pay the Department of Fish and Game for the stocking of 38,800 pounds of trout and 500,000 kokanee salmon per fiscal year in the Pit River.

In October 1966, the Department of Fish and Game and PG&E agreed to change this planting operation to cease the stocking of kokanee salmon, and PG&E is to pay for the stocking of 38,800 pounds of trout per fiscal year in drainages of the McCloud and Pit Rivers below the uppermost PG&E installation (Pit #1) downstream to and including Lake Shasta (Weidlein, pers. comm.). Further, PG&E agreed to pay \$5,000 per 3-year period toward evaluation of the fish stocking program. The Department of Fish and Game has been applying these evaluation funds toward rewards offered for the return of tagged fish.

Pit #6 has in-stream flow release requirements which are included as a term in state water rights license #9189 (issued March 11, 1970). It states that the "licensee shall release flows in the stream below the point of diversion in such quantities as to keep in good condition any fish that may exist or be planted in the stream below the point of diversion".

IV. Post-Project

Flows illustrated in the post-project hydrograph (Figure 3) show an increase in flows in the Pit River over pre-project conditions. This increase is attributable to diversions from the McCloud River to the Pit River which began in December 1965. The average discharge through the interbasin diversion tunnel during a 7-year period (1966-73) was 1,080 cfs (USGS Station

11367720, Vol. 2, 1973). The water enters the Pit River through a power plant just above Pit #6 Reservoir (see Figures 1 and 2).

The Pit River immediately below Pit #7 dam does not support any permanent fishery due to scouring and fluctuating flows from the powerhouse and change of Shasta Lake levels.

Below the Pit #7 afterbay at Fenders Ferry, the Department of Fish and Game plants Pit River rainbow trout, silver salmon and brown trout. The department has found that domesticated strains of rainbow trout incur high mortality from Ceratomyxa shasta, a protozoan parasite that is prevalent in the Pit River drainage. This organism finds optimum epidemic conditions in warm water. Summertime discharges from the warm top layer of Pit #7 reservoir increases the chances of parasitic infestation in rainbow trout other than the native Pit River strain (Weidlein, pers. comm.).

V. Conclusions

In 1961 the Federal Power Commission issued FPC license No. 2106 for the Pit-McCloud project. A stipulation of the license included a minimum instream flow release below Pit #7 of "150 cfs at all times except when the elevation of Shasta Lake is at the invert of the draft tube of Pit #7 powerhouse".

Flows illustrated in the pre- and post-project hydrographs (Figure 3) show an increase in flows in the Pit River over pre-project conditions.

The increase is attributable to diversions from the McCloud River to the Pit River which began in December 1965. Flows downstream of Pit #7 dam appear to be in excess of the daily instream flow reservation of 150 cfs (Figure 3). During the 1,460 days of record (1968-1971), only one day (June 26, 1971) occurred when the average daily flow was less than the required instream flow reservation.

The minimum instream flow reservation of 150 cfs was selected by Department of Fish and Game personnel and was based primarily on personal knowledge of the Pit River and its fishery.

No evidence was discovered that a quantitative study was made to determine the amount of fish and wildlife habitat effected by the Pit #6 and #7 project. These dams block fish migrations from Lake Shasta into the river. To compensate for the lack of spawning habitat, PG&E pays the California Department of Fish and Game to stock 38,800 pounds of trout and 500,000 kokanee salmon per fiscal year in the Pit River. This program was reevaluated each year for a period of three years following the commencement of the program.

Stocking of kokanee salmon did not prove to be successful and subsequently was terminated in 1966. However, the annual stocking of 38,800 pounds of trout was successful and was continued.

The Pit #6 and #7 project had a significant adverse impact on fish in the McCloud River because water was diverted from the McCloud to the Pit River to make the project more functional for power productions.

BIBLIOGRAPHY

Personal Communications

Weidlein, Donald. January 19, 1973. California Department of Fish and Game.

References

Curtis, Brian. 1959. Changes in a river's physical characteristics under substantial reduction in flow due to hydroelectric diversion. California Fish and Game, 45(3).

U. S. Geological Survey. 1973. Water resources data for California. Part I - surface water records.